Report to the Energy Efficiency Utility Contract Administrator

Verification for Efficiency Vermont Year 2002 Savings and Total Resource Benefit (TRB) Claim

Department of Public Service

June 16, 2003

Summary

On April 1, 2003, Efficiency Vermont (EVT) filed its Annual Report on its calendar year 2002 activities and results operating as the Statewide Energy Efficiency Utility. As specified in the contract between Efficiency Vermont and the Vermont Public Service Board, the Department undertook a review of EVT's 2002 activities with the goal of "verifying" the annualized MWh savings and Total Resource Benefit claimed by EVT. This report to Michael Wickenden, Contract Administrator for the PSB, summarizes the results of that review.

The DPS and EVT have reached agreement on all issues raised in the review. The agreement results in a reduction of 969,506 "gross at customer meter" annualized kWh savings, 12,620 "net at generation" kWh's, and 415 summer peak KW savings, representing roughly 3% of EVT's 2002 annualized MWh savings claimed in its April 1 report. These adjustments will flow to associated reductions in KW savings and the claimed Total Resource Benefit (TRB) and will be recalculated by EVT.

EVT's contract contains a 2002 performance indicator to achieve average per household gross savings of at least 1,000 kWh per year in the Low Income Single Family Program. The DPS carefully reviewed the measure-level savings for this program and recommended some adjustments with which EVT agreed. Even with these adjustments, the per household savings in the program in 2002 were 1,640 kWh, indicating that EVT exceeded the performance indicator by a wide margin.

This report contains a brief discussion and resolution of the subjects raised in the verification review process and a summary compilation of the agreed upon savings adjustments. The review process also identified a number of issues the parties agree will be addressed through established processes related to the technical reference manual review and technical advisory groups and, as appropriate, the information technology group.

The DPS commends all EVT staff involved in this process. Their professionalism in sharing their time and knowledge has made this process one that continues to strengthen both parties' understanding of the issues confronting Efficiency Vermont and the DPS in our mutual efforts to continue advancing the goals of the statewide energy efficiency utility.

Introduction

Efficiency Vermont has, for the most part, been diligent in reflecting the agreements among the parties and correctly recording the prescriptive savings and net-to-gross values as recorded in its technical reference manual. The modifications to residential savings claims

identified in this report are at least in part the result of EVT's success in promoting lighting products. Adjustments in the C&I programs are primarily those related to large projects where errors occurred in calculating and adjusting savings for Act 250 projects and custom measures. Most of the adjustments relate to:

- the unintended ramifications of Efficiency Vermont's substantial progress in promoting lighting products,
- concerns about certain assumptions for custom measures not included in the reference manual,
- the accuracy and lack of transparency of some analysis tools employed by Efficiency Vermont to calculate savings and cost effectiveness, and
- the calculation of savings for specific custom measures.

The DPS annual verification of EVT's claimed annual MWh savings and TRB is undertaken to determine the appropriateness of EVT's annual claims. While the results reflect a focus on assuring claims are not overstated, the process can and does on occasion uncover instances where savings claims are underestimated. Where appropriate, those items are identified and quantified where sufficient information is available.

DPS Review Process

Over a two-and-a-half month period covering April, May and part of June, 2003, DPS staff members Tom Franks, Chris Owen, Randall Lloyd and Carole Welch worked with DPS contractor West Hill Energy and Computing to plan and implement the review, and to develop the conclusions and recommendations contained in this report. One change from the 2001 verification process was that the DPS was not able to retain the services of engineering consultant, SAIC (Science Applications International Corporation), to assist in reviewing large, complex projects.

In the C&I sector, West Hill used EVT's project database to construct a list of projects proposed for the review. DPS staff selected twenty-six out of a total of 664 projects completed in 2002 for detailed review. The process for selecting these projects was as follows:

1. All projects were ordered by size (total kWh savings) and most of the top 25 projects were selected for review.

2. All projects were grouped first by program and then by size, and a few of the largest projects in each program (if not first identified in step 1) were selected.

3. All measures were ranked by size (total kWh savings) and projects with high measure-level savings or unusual measures were chosen (if not already marked in steps 1 and 2 above).

4. In addition, a few small projects in C&I programs were selected for review.

In the residential sector, the average per project savings were calculated for each end use and compared to the TRM characterization for prescriptive measures or checked against known usage and savings patterns for custom measures. Where the average per project savings deviated from expected patterns, the Department further investigated the measures within the end use to identify the source of the deviations. In each program, the projects with the largest savings were reviewed to assure that the savings were reasonable. West Hill Energy also used EVT's database to check savings assumptions for prescriptive measures against the reference manual.

Multiple site visits to EVT offices were made during April and May to review project files and discuss projects with EVT staff. West Hill developed spreadsheets extracted from EVT's database that contained detailed measure and project data for each EVT program. Electronic and hard copy files from selected projects used by EVT to calculate savings and screen measures were reviewed.

The DPS provided EVT with a list of preliminary findings and issues on May 20. EVT provided its written response the following week, on May 29, and a meeting between EVT and the DPS was held on June 5. At that meeting and in subsequent discussions, mutually agreed upon resolutions were reached on all identified issues.

Findings

This report and recommendation to the Contract Administrator summarizing the results of the DPS review is presented under one of four categories, as follows:

Category 1: Unresolved Issue with Adjustments
Category 2: Resolved Issues with Adjustments
Category 3: Issues Without Adjustments, Requiring Future Attention
Category 4: Other Issues

As resolution was reached on all issues raised by the DPS in its preliminary findings, there are no Category 1 issues in this report and recommendation. The category 2 items will, in general, require further action as will those discussed in categories 3 and 4. Most, if not all, of the issues identified and discussed under categories 2, 3 , and 4 will be referred to a Technical Advisory Group (TAG) or to the Information Technology (IT) group, as appropriate.

Category 1: Unresolved Issues With Adjustments

There are no unresolved issues with adjustments resulting from this review.

Category 2: Resolved Issues with Adjustments

EVT and the DPS have reached agreements on specific adjustments for the following measures as shown on the attached chart. These adjustments are divided into two categories: (1) global adjustments applied to all or a group of projects within a program and stemming from a systematic problem, and (2) project adjustments that relate to a specific error or oversight. Although not specifically listed in category 3, all of these global issues should be discussed and resolved for future savings claims through the TAG process.

(1) Global Adjustments

Commercial Energy Opportunities (CEO) Program

Free Rider Rates for Space and Water Heating Fuel Switching Measures. EVT's 2002 savings claim includes space and water heating fuel switch measures in a number of its programs, including the CEO, CEOFARM, CIEM, and REM programs. EVT applied free rider factors ranging from 0% to 10% for these savings. The DPS and EVT have agreed to a retroactive adjustment from 0% to 5% for fuel switching measures installed in the CEO New Construction and CEO Farm components. This reduction does not change the 'gross at customer meter" savings, only the "net at generation" annualized kWh savings. The reduction is roughly 10,419 "net at generation" kWh for the CEO Program. The factors used by EVT to claim 2002 savings and the agreed upon factors that will be applied retroactively are shown in the following table.

Program/ Component	Space Heating Fuel Switch Free Riders		Water Heating Fuel Switch Free Riders	
	EVT 2002 Claim	DPS-EVT Agreed Upon	EVT 2002 Claim	DPS-EVT Agreed Upon

CEOFARM	0%	5%	0%	5%
CEONEW	0%	5%	0%	5%

EVT and the DPS have agreed that discussions concerning appropriate adjustments to fuel switching measures installed through its initiatives going forward are a high priority and will be pursued on an expedited basis in upcoming TAG processes.

CEO Act 250 Adjustment factors. The adjustment factors applied to Act 250 projects have been a source of errors in savings claims by EVT. Since Year 2000, EVT and DPS have had lengthy discussions about how savings claims for EVT projects should be adjusted to account for the influence of the Act 250 regulatory process on certain projects. For two decades, DPS has reviewed Act 250 projects under criterion (Criterion 9F) in a way that has a positive impact on energy efficiency levels compared to non-Act 250 projects, suggesting that EVT should not take full credit for energy savings in those cases. Based on this, a matrix of adjustment factors were agreed upon, which reflected historic treatment received by various types of Act 250 projects, (e.g. resort master plan, large projects over 30,000 square feet, etc.). However, these factors have frequently been mis-applied and produced inaccurate savings claims. Further, the factors added a level of administrative complexity for EVT project managers.

The DPS and EVT have agreed to eliminate the Act 250 adjustment factors for Year 2003 and later projects in light of changing market conditions and the complexity they produced for record keeping. In the verification negotiations, EVT agreed to provide the DPS with the document it considers the latest version of the agreement and to identify any remaining issues that still require resolution. The parties further agreed to strive for resolution on all remaining outstanding Act 250 related issues.

Among the 2002 C&I projects reviewed, EVT has agreed to modify savings for three of its projects with Act 250 permits. In those cases, DPS identified inaccurate application of adjustment factors for projects at U-32 High School, Woodstock Resorts, and Shaw's Supermarket at Maple Tree Place. The adjustments are more fully described below under the individual project reviews.

Residential New Construction Program

Prescriptive Lighting Products. Efficiency Vermont has been very successful at promoting efficient lighting products in the residential sector. To date, the savings have been calculated prescriptively; that is, a set amount of savings is claimed for each product. This process has a major advantage in its simplicity. However, as the programs reach a larger market share and more customers purchase a greater number of products, some unintended ramifications of this

approach are becoming apparent. The main issue is that the total savings per household (for all products purchased) are increasing beyond what may be considered reasonable.

The 2002 program savings result in average annual savings of 1,812 kWh per household. For perspective, estimates of **total** per household lighting usage ranged from 900 to 1,200 kWh per year. Recent studies seem to indicate these values are low and it is likely the usage in new homes tends to be higher than in older homes. Assuming that a more reasonable usage range may be 1,400 to 1,600 per year, the per household program savings still seems quite high. EVT explained that some of the excessive savings may be related to a mischaracterization of certain lighting fixtures.

EVT has agreed to reduce lighting savings in the program by 25%. This results in an annualized savings reduction of 237,114 annualized kWh.

Low Income Single Family Program and Residential Emerging Markets

Water Heating Fuel Switching. The DISTool used in the LISF and REM programs to determine the usage related to water heating requires numerous and highly detailed inputs. For each project, an energy auditors asks numerous questions about water usage patterns, including length of showers and number of showers and baths per week for each occupant of the home. The results of the tool are sensitive to small changes in the inputs. For example, at some point during 2002 the default recommendations for the length of the shower changed from 12 minutes to 10 minutes. Making this slight modification to the defaults can result in changing the hot water usage by 1,000 kWh or more. Given that these inputs are dependent on answers from the participants who may not know how long they stay in the shower or may not feel compelled to provide accurate information about their bathing habits, this process is highly cumbersome and likely to produce inaccurate results. The Department's analysis indicates that the DISTool consistently overestimates savings for a sample of homes with higher DHW usage.

EVT agreed to reduce the kWh, KW and TRB savings by 15% for 67 LISF and 61 REM projects with annual measure savings greater than 5,000 kWh, as shown on the attached spreadsheet.

Double Counting of Fuel Switch and Conservation Savings. For 20 projects in these two programs, savings were claimed for both hot water conservation and water heat fuel switching measures installed during 2002. About 9,500 kWh's were claimed for conservation measures installed in homes that also switched fuels. While the Department agrees with EVT's approach of installing the water conservation devices at the time of the audit even if the customer later decides to switch fuels, the savings should be claimed only once.

EVT agreed to remove the savings associated with the conservation measures for those participants who switched fuels, resulting in a total reduction of 9,508 kWh.

Residential Emerging Markets Program

Space Heat Fuel Switching for Seasonal Homes. The Department found some systematic discrepancies in the methodology used to estimate the usage associated with electric space heat for seasonal homes. In a number of analyses reviewed by the Department, the base usage was estimated from a month when the home was unoccupied, leading to an underestimation of total base usage and consequent overstatement of electric space heating usage.

EVT agrees that the savings from space heating fuel switches for 16 projects likely to be seasonal home should be reduced by 15% or 22,296 kWh.

(2) Project-Specific Adjustments

CEO Program

U-32 Jr/Sr High School (project 6014 1582). This was a large and complex school construction and renovation project. DPS raised concerns about three savings claims; two have resulted in the adjustments described below.

One adjustment relates to an error in data entry by EVT, which resulted in the improper Act 250 adjustment being applied. EVT and DPS had previously agreed upon certain adjustment factors for Act 250 projects such as this. In general, custom energy measures in "major" projects have their savings reduced 25 percent; minor Act 250 projects have savings reduced 5 percent. The reductions are intended to account for savings that occur from DPS participation in the Act 250 review process.

Savings Adjustment: 48,641 kWh

The second agreed-upon adjustment in the U-32 school project involved whether EVT used suitable "baseline" lighting technologies. EVT assumed mercury vapor and incandescent baselines as the basis for measuring savings. DPS asserted that more efficient alternatives are commonplace and constitute a more accurate baseline. Following discussions, EVT agreed that mercury vapor was not the proper baseline to measure savings for the pulse start and high pressure sodium lamps.

Savings Adjustment: 187,880 kWh

Woodstock Resort (project 6014 1351) This customer had received three Act 250 permits in recent years. The DPS assumed the this project, or portions of it, received an Act 250 permit and thus should be treated as an Act 250 "minor" project with an adjustment factor of .95. EVT agreed that an improper adjustment factor had been applied and downgraded the savings claim by five percent.
Savings Adjustment: 2,270 kWh.

1.33 Maple Tree Place Projects Act 250. DPS examined the savings claims of four buildings in this new retail complex in Williston: Shaws' Supermarket, Chili's Restaurant, Building "M" and the Paper Peddler, a retailer. Following this review and discussion with EVT staff, energy savings were reduced for Shaw's and Building M.

Shaws: EVT erroneously calculated energy savings using the "minor" Act 250 adjustment factor – 95 percent for custom measures. It agreed to use the major project adjustment of 75 percent, consistent with agreements with DPS for adjusting savings in Act 250 projects.
Savings Adjustment: 39,280 kWh

Maple Tree Place Building M Ventilation. An error was made in the transfer of savings from the analysis tool to the screening and Fast Track database. EVT claimed 59,507 gross kWh, but the correct number is 1,831 kWh, for a reduction of 57,676 . EVT has agreed to make this adjustment.
Savings Adjustment: 57,676 kWh

Snowmaking at Bromley and Jay Peak (projects 6013 2347 and 6013 1723). Efficiency Vermont claimed summer peak savings for the snowmaking measure installed at these two ski areas. EVT agrees these savings should be removed, as shown on the attached spreadsheet.
Peak KW Adjustment for Bromley: 267 Kw
Peak KW Adjustment for Jay Peak: 148 Kw

Burlington Food Warehouse. Adjustments to the lighting savings for this project stem from two sources: the inappropriate application of prescriptive lighting savings to a custom project and the overstatement of the number of fixtures affected by the lighting controls. From the Department's understanding of this project, it was concluded that the savings from the installation of metal halide fixtures resulted from the higher lumen output of the efficient bulbs and the resulting reduction in the number of fixtures. EVT, however, claimed savings on the basis of a wattage reduction. The adjustment was determined by calculating the estimated savings from 20% fewer fixtures and comparing this number to the savings claimed by EVT. Correcting the error in the number of fixtures affected by the lighting controls (60 instead of 81) was calculated on a prorated basis. The DPS also made a small increase in savings to account for the incorrect hours of usage for the LED exit signs. These adjustments result in a net reduction of 21,464 gross kWh.

Occupancy sensors: EVT initially informed DPS that all of the MH fixtures were controlled. When asked why the control savings were based on 81 fixtures when it appeared that only 70 had been installed, EVT responded that the occupancy sensor actually affected 60 fixtures rather than 70 (or 81). Savings were adjusted by 60/81, or 6,430 kWh.

LED exit fixtures: These savings were erroneously calculated based on 7,656 hours rather than 8,760 hours. The DPS corrected the calculation and added the small incremental savings (288 kWh).
Total Savings Adjustment: 27,606 kWh

Economizer Peak Savings (Catamount Middlebury, et. al.). For a group of six projects, an error was made in the calculation of the coincident peak savings. The commercial AC load shape was used instead of the correct economizer load shape. EVT agrees to re-calculate the coincident peak savings for these projects.

CEO Farm Component

Replacement of failed Orion Compact Flourescent Light fixtures. The 2002 savings and TRB includes prescriptive savings amounts for 41 T-8 fixtures installed to replace failed Orion compact flourescent light fixtures recommended and installed under EVT's farm program in January 2001. EVT correctly funded the T-8's to replace the problematic product previously recommended to the farmer. However, the savings duplicate those already claimed by the program in 2001 and should not be recounted. EVT agrees.
Total Savings Adjustment: 9,005 kWh.

Spillover assumption for compact fluorescent interior light fixture. EVT incorrectly applied a 5% spillover assumption to 198 measures identified as compact fluorescent interior light fixtures installed during 2002. EVT agrees to correct this error. This reduces the "net at generation" annualized kWh savings by 2,201.

CEO Farm Lighting Savings. The tracking system incorrectly labeled at least some T-8 measures as indoor compact fluorescent fixtures. That resulted in errors in gross savings application, associated TRB related applications, and incorrect spillover adjustments. EVT agrees to make the appropriate corrections.

Efficient Products Program

Torchieres. The prescriptive savings for torchieres were incorrectly entered into the FastTrack database for a significant number of participants. In the process of correcting this error, EVT also discovered that the savings listed in the reference manual are incorrect.

EVT agree to correct this error for the 2002 program year, resulting in a reduction of 123,341 kWh, as shown on the attached spreadsheet.

REEP

Space Heat Fuel Switching Project. In project 6017-1242, the savings from switching space heat fuel were calculated from a theoretical heat load but were not properly adjusted for actual usage patterns, as is commonly done for the residential sector. EVT agrees to reduce the savings by 50% or 29,095 kWh annually.

Category 3: Savings Issues Without Adjustments, Requiring Future Attention

The issues listed under this category were identified during the verification process, but did not rise to the level of requiring adjustments to the year 2002 savings and TRB claim. In general, these issues will be addressed in the technical reference manual update process or referred to the appropriate Technical Advisory Group for consideration.

LISF Early Replacement Refrigerators. The Department is pleased that Efficiency Vermont has added this measure to the Low Income Single Family program. This approach seems to be a good strategy to reduce the prevalence of older, high-use refrigerators in this market . We understand that the procedure is to meter the refrigerators while the auditor is in the house, usually one to two hours, if possible, and then base the savings on the annual usage calculated from the metering. If it is not possible to meter, then the savings are estimated from manufacturers' estimates available from Planergy.

As recently discussed in a *Home Energy* article, metering savings can be unreasonably high if the defrost cycle happens to be coincident with the metering period.[1] This article also suggests a simple method for disabling the defrost cycle to ensure that the metering savings reflect typical usage. The DPS requests that EVT review the metering procedures and adopt a strategy to minimize or eliminate the possibility of the metered usage reflecting unrealistically high usage associated with conducting the metering during the defrost cycle.

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[1] "Taking the Pain Out of Testing", *Home Energy*, May/June 2003, pp. 30-34.

EP Correction of torchiere savings. The annual kWh savings estimate for torchieres in the reference manual was incorrect. The reference manual gave the savings as 329 kWh, but the correct savings are 287 kWh. EVT has rectified this error and the amendment will be distributed with the next update of the reference manual.

EP Household Lighting Savings. The Department's analysis of lighting in this and other residential programs shows an increasing trend in total savings claimed per household, as further discussed under the kWh adjustment recommended for the RNC program. In the Efficient Products Program, about one third of the 2002 participants expected to save 1,000 kWh per year or more. This level of savings seems high, given that average household lighting usage has been estimated in the 900 to 1200 kWh range. However, we were not able to identify purchases for multifamily homes, and some of these households in this high savings category are likely to be multifamily homes. At this time, the Department does not suggest adjustments to the EP savings. However, the DPS and EVT should address this "per household" lighting use and savings trend and discuss alternative approaches to claiming savings for the Efficient Products market in 2003.

CEO Program Measures with high operation and maintenance (O&M) requirements. The Department believes additional attention to establishing mechanisms to adjust estimated savings for O&M intensive custom measures is appropriate. This may involve the application of persistence factors, or other appropriate adjustments, for high O&M measures which do not incorporate O&M follow-up or commissioning services. The DPS recommends that EVT establish appropriate adjustments to its reported measure savings for all high O&M measures such as programable lighting, energy management, ventilation controls and other automated microprocessor based energy optimization and variable load systems to account for energy savings realization rates which are likely to be lower than engineering estimates. DPS proposes that EVT include appropriate persistence factors to its savings calculation algorithms for high O&M measures such as the adjusted measure life formula introduced in the TRM for compressed air controls or the "CXC" variable similar to that established for variable frequency drive measures.

Interactive Savings. In reviewing the project files for 2002 projects, the DPS initially had questions about the application of the interactive effects. These questions were subsequently answered by EVT. However, the DPS noted that the types of interactions found in the 2002 completed projects are more complex than originally envisioned and we would like to discuss possible modifications to the baselines and the methodology for calculating interactive effects through the C&I TAG process.

CEO Program. Project Tracking for Small New Construction Projects . EVT does not track project completions and estimated savings for certain small new construction projects which have received limited technical services, but not financial incentives. The DPS

acknowledges EVT's reluctance to spend valuable staff time and resources "chasing down" small projects in order to assess compliance with the minimum energy performance standards pursuant to ACT 250 permits and the *2001 Vermont Guidelines for Energy Efficient Commercial Construction*. The DPS and EVT will discuss prospects for monitoring these projects in the future as part of its Act 250 follow up discussions.

Farm New Technology. Two of the reviewed projects include the installation of a few very large ventilation fans that replace many smaller fans. The estimated savings is significant, with the potential to provide summer peak savings. EVT plans to informally monitor these installations to better understand the potential of this measure to reduce summer peak KW and will keep the DPS informed of the monitoring results.

Category 4: Other Issues

Some of the issues raised relate more to program implementation processes rather than simply savings calculations. EVT and the DPS have agreed to establish an approach to discuss and resolve these issues prospectively.

CAT tools: In its preliminary findings, the DPS raised some issues related to EVT's use of older versions of CAT tools. EVT indicated versions 1c, 1d, and 1e will no longer be in use. In the negotiation discussions, the parties identified the use of the appropriate CAT tool version as an item that needs further exploration. The parties agreed to take this up in a future C&I TAG meeting.

CEO Program: Non Quantified Benefits for Large C&I Projects. The Department reiterates an interest in having EVT provide input to the DPS to characterize productivity changes made in conjunction with industrial and large commercial efficiency projects. This might involve documenting additional tangible benefits that are not currently addressed or quantified in the TRB calculation methodology such as improved power factor, reduced customer bills, reduced on-site emissions and production waste, improvements in productivity and working conditions, reduced utility bill arrearage, local economic development "multiplier effects", local job creation, and other items EVT encounters in its program implementation. Related to this effort, the parties should consider how offsets could be estimated for projects which are likely to result in additional electrical demand due to increased manufacturing output.

REEP File Documentation. In the 2000 verification report, the DPS noted that hardcopy files frequently contained numerous missing or undated documents. The DPS suggested that EVT institute internal procedures to assure that project documentation is complete and accurate and to identify where documentation resides (paper or electronic files) would be beneficial. The 2002 review indicates that there are continuing problems in this area. EVT and the DPS have discussed possible improvements to the file documentation.

REEP Measure Documentation. It is not possible to match particular measures to particular dwelling units in the FastTrack database. While the DPS agrees that this level of detail is not necessary for direct install lighting and many prescriptive measures, we found it somewhat disconcerting that we cannot determine the number of dwelling units affected by a space heating fuel switch without making a special request to EVT. The DPS and EVT has agreed to address this issue through the TAG process.